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Description of how grades may be predicted from preadmission data (e.g. high school average, aptitude tests) and prediction formulas, based on empirical studies, for computation of such estimates. Information provided on range of error.

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The Prediction of Grades for Applicants at the Woman's College of the University of North Carolina

I. Purpose:

The purpose of this bulletin is to describe how estimates of grades at Woman's College for applicants or students may be computed from pre-admissions data, and to provide formulas, based on empirical studies, for computation of such estimates. Also, information is provided on the range of error that may be expected in these estimates, a value accurately known from research with freshmen entering the College in 1958.

This information is provided as an essential background for the formulation of admissions policy, and to provide an equitable basis for ranking applicants for admission. However, the findings also have implications for identifying over or under achievement, in selective recruiting, or other situations where an estimate of academic promise would be helpful.

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II. Source of Data:

This report is based on a study of 619 regular freshmen and 170 commercial students entering the Woman's College for the first time in the fall of 1958. Of those new students originally registering, seven freshmen and eight commercial students were excluded because of absence of data on one of the pre-admissions indices used, and sixteen freshmen and six commercial students were excluded because of withdrawal without grades or with failing grades before the end of the first term. Freshmen enrolled in the Nursing curriculum were also excluded, and will be the subject of a separate study.

III. Predictive Measures and Criteria of Academic Achievement:

Experience over the country has generally shown that the high school average or rank in class is the best single predictor of grades in college, in spite of differences among high schools, grading standards, etc. As rank in class was available for only 99 freshmen, the measure tested for use as a predictor of grades was the high school average, or HSA. Using standard rules agreed upon by the Consolidated University Admissions Research Committee, A was assigned a value of 40, B a value of 30, etc., and a mean was computed. Such a rating was computed from the transcripts of the students studied.

A second type of measure found generally valid for predicting

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academic achievement in college is that provided by tests of general intelligence such as the College Board Scholastic Aptitude Tests, required of all entering freshmen in 1958. Generally, these measures work well not only by themselves, but also add to the accuracy of prediction available from the measure of past achievement provided by the high school record. This is to say, for example, that an applicant with a high HSA and low ability score is less likely to succeed in college than an applicant with the same HSA but a high ability score. Therefore, the two measures provided by the Scholastic Aptitude Tests, Verbal and Mathematical sections, were also tested as predictors of college grades. These measures are expressed on a scale of about 200 to 800, where 425-450 would be the national average for all colleges, or 500 the average for college freshmen in those generally highly selective institutions which have used the College Board tests in the past. The verbal score is a measure of general verbal intelligence, or ability to work with ideas expressed in language, and is relatively unaffected by training, experience, or cultural background. The mathematical score is a measure of general ability or aptitude to handle ideas expressed in mathematical form.

In a separate series of studies, entering freshmen were also given three subject-matter achievement tests from the Sequential Tests of Educational Progress series. These involved a test of ability to apply learning from the areas of mathematics, social sciences, and natural sciences. Although these tests are not included in the formulas for predicting grades as they would usually not be available until after the act of admissions, their relationships with other predictor and criterion variables were determined for whatever meaning they might add to the other findings.

For entering freshmen, two academic criteria were employed. The first was the conventional honor point ratio computed by the registrar from first term grades by assigning A a value of 40, B a value of 30, C a value of 20, and D a value of 10, and then dividing by the total number of credit hours. The second criterion was computed in the same way except that F grades were assigned a weight of zero, and the mean was obtained by dividing the summation by the total number of credit hours taken (including F's).

IV. Basic Findings:

The relationships between the various predictors and the first term averages are given in Table 1 for the entering freshmen, and in Table 2 for the Commercial students. The tables also give the means and standard deviations[1] for each variable.

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[1] A standard statistical measure of range or variability of scores. In general, about two-thirds of a group will fall within plus or minus one standard deviation of the mean, or 96% within plus or minus two standard deviations from the mean.

TABLE 1

Relationships between Various Predictors and First Term Averages for 1958 Entering Freshmen at the Woman's College (N = 619)

		CEEB		STEP Tests				
Variable	TAG_2	SATV	SATM	Math	Sci.	Soc.Sci.	HSA	TAG_1
TAG_2	X	.590	.426	.361	.377	.492	.444	.928
SATV		X	.514	.422	.531	.696	.213	.596
SATM			X	.512	.431	.370	.242	.427
Math				X	.508	.409	.139	.363
Sci.					X	.526	.169	.361
Soc.Sci.						X	.121	.481
HSA							X	.389
Mean	19.6	446.9	449.2	233.1	232.7	290.2	31.7	20.8
Stan. Dev.	7.1	38.6	74.8	10.6	9.4	11.6	5.6	6.0

Table 2

Relationships between Various Predictors and the First Term Average for Commercial Students Entering the Woman's College in 1958 (N = 170)

Variable	TAG_2	SATV	SATM	HSA
TAG_2	X	.298	.367	.445
SATV		X	.415	.197
SATM			X	.151
HSA				X
Means	24.2	390.5	404.7	30.5
Stan. Dev.	7.1	75.7	66.2	5.9

(Note: "TAG_1" is term average, F's excluded; "TAG_2", F's included.)

The data in Table 1 may be interpreted by stating that of the three pre-admissions indices tested (SATV, SATM, and HSA), the best single predictor of the term average grade is the SATV score. However, the HSA and SATM scores also perform reasonably well. Of the three achievement test measures, the Social Science test is most highly related to later college grades, although this may be explained in part by its high relationship with SATV. Table 2 shows that the tests do not predict grades for commercial students as accurately as for freshmen, although the HSA is as good a predictor for this group as for the freshmen.

Using multiple regression techniques, several predictors may be combined to provide a more accurate prediction than that available from any single score. The criterion which includes F grades (TAG_2) was selected; combining SATV, SATM, and HSA to predict TAG_2 yields a correlation coefficient of R = .681 for the freshmen and R = .548 for the commercial students. In both instances, the combination of all three measures substantially improves the accuracy of prediction. To some degree for both groups, each of the predictors measure different factors, and each factor reflects something important in college achievement at the Woman's College.

IV. <u>The Prediction of Grades from Pre-Admissions Data</u>:

The data in tables 1 and 2 may be converted to prediction equations. Using the combination of predictors to capitalize on the greater accuracy, these equations are:

(Freshmen) PTAG = .037(SATV) + .010(SATM) + .404(HSA) - 14.584

(Commercials) PTAG = .011(SATV) + .028(SATM) +.460(HSA) - 5.373

Solving these equations for PTAG, or predicted term average grade, by substituting the scores and high school average in the formula yields a prediction of maximal accuracy. The derived weights also give, therefore, the most satisfactory combination of these three measures.

As the degree of relationship between the three predictors and the criterion affords a measure of accuracy, this may be converted to an estimate of the range of errors in predictions so derived. Table 3 gives the amount of variation of actual grades from predicted grades that may be expected when the formulas above are used. In general, 50% of the freshmen will later fall within three points (on the forty point scale) of the prediction, while 50% of the commercials will fall within four points of prediction.

TABLE 3

Accuracy of Prediction when Optimal Weighting of Predictors is Used: Proportion of Students whose Actual Grades Vary from Predicted Grades within Selected Values

Variation: Actual from Predicted	Proportion (Liberal Arts)	Proportion (Commercials)
± 01	18%	14%
± 02	34%	26%
± 03	50%	38%
± 04	63%	50%
± 05	70%	60%
± 06	83%	69%s
± 07	89%	76%
± 08	93%	82%
± 09	96%	87%

Thus, an applicant with SATV score of 300, SATM score of 400, and a High School Average of 20 (C) would have a predicted grade among the Woman's College freshmen of about 09, or D-; this information is obtained from substituting the scores in the formula. Table 3 shows that of such applicants in the past, 50% would actually make grade averages between 06 and 12.

The fact that range of error and frequency of amount of error can be determined means that one can also determine the likelihood or probability that an applicant with a given predicted grade will actually achieve any other selected grade, such as the average required for graduation or retention. Table 4 gives such an interpretation of the error of estimate for predictions for freshmen applicants. An applicant with a predicted grade of 20, for example, would have about nine chances in a hundred of making a B- (or 26) average or better, or 82 chances in a hundred of making a C- (16) or better average. This derives from the fact that of those entering freshmen in 1958 with predicted grade of 20, about nine percent made a B- average or better, while about 82% of these applicants made a C- average or better.

TABLE 4

Percentages of Freshmen with Selected Predicted Grades Who Achieve or Excel Various First Term Average Grades

Predicted Grade	Percent who Achieve or Excel the Term Average Shown				
	A- (36+)	B- (26+)	C (20+)	C- (16+)	D- (6+)
36	50				
35	41	98			
34	33	96			
33	25	94			
32	18	91			
31	13	87			
30 (D)	09	82			
29	06	75	98		
28	04	67	96		
27	02	59	94		
26		50	91		
25		41	87	98	
24		33	82	96	
23		25	75	94	
22		18	67	91	
21		13	59	87	
20 (C)		09	50	82	
19		06	41	75	
18		04	33	67	
17		02	25	59	
16			18	50	
15			13	41	98
14			09	33	96
13			06	25	94
12			04	18	91
11			02	13	87
10 (D)				09	82
9				06	75
8				04	67

Interpretative Note: Table 4 shows that of the 1958 entering freshmen with predicted grade of 21, for example, less than two percent achieved an A- average the first term, 13 percent achieved a B- or better average, 59 percent a C average or better, 87 percent a C- average or better, and more than 98 percent a D- or better average.

TABLE 4A

Percentages of Commercial Students with Selected Predicted Grades Who Achieve or Excel Various First Term Average Grades

Predicted Grade	Percent who Achieve or Excel the Term Average Shown				
	A-	B-	C	C-	D-
36	50	95			
35	43	93			
34	37	91			
33	31	88			
32	25	84	98		
31	20	80	97		
30 (B)	16	75	95		
29	12	69	93		
28	09	63	91	98	
27	07	57	88	97	
26	05	50	84	95	
25	03	43	80	93	
24	02	37	75	91	
23		31	69	88	
22		25	63	84	
21		20	57	80	
20 (C)	16	50	75		
19	12	43	69		
18	09	37	63	98	
17	07	31	57	97	
16	05	25	50	95	
15	03	20	43	93	
14	02	16	37	91	
13		12	31	88	
12		09	25	84	
11		07	20	80	
10 (D)		05	16	75	
9		03	12	69	
8		02	09	63	

V. Implications of Findings for Selective Admissions Policy:

For both freshmen and commercial students, the pre-admissions indices tested are sufficiently related to first term performance that their use in selective admissions seems completely justified. Utilizing the pre-admissions indices as criteria promises to provide a group of students more likely to live up to the qualities rewarded by the faculty through the grading system.

For both freshmen and commercials, sufficient improvement in accuracy of prediction is obtained when the criteria are combined to indicate that this should be done in ranking applicants for selection purposes. Weighting the criteria as indicated by the prediction formulas provides the most satisfactory procedure for combining the measures.[1] This translates the three scores into a prediction of grade at Woman's College; such a prediction may be referred to Table 4 or 4A to determine the proportion of applicants with any given predicted grade who will achieve at any selected minimum grade level.

Thus, "cut-off" scores on any one index such as a test score or the high school average is not upheld by this research. Neither is the practice of adding the two test scores together, as recommended by the Consolidated University Admissions Committee, likely to provide the most appropriate method of deciding which applicants to reject or to admit. For example, the formulas may be solved to show that an applicant with SATV of 300, SATM of 400, and High School Average of C (20) has a predicted grade of 08.6 (D-), and a probability of attaining a first term average of C- or better of .06 (i.e., six such applicants of every 100 would attain C-). An applicant with the same high school average but with SATV of 400 and SATM of 300 would have a predicted grade of 11.3 (D+), and a probability of about .14 of attaining a C- average. An applicant with SATV of 400, SATM of 300, and high school average of A (40) would have a predicted grade of 19.4, and a probability of about .78 of attaining the C- or better average.

It would therefore follow that applicants for admission should be ranked on the combination of pre-admission indices provided by the predicted grade. Admission decisions could then be made by consideration of the degree of risk that is fair to the applicant and the taxpayer, the number and quality of the current crop of applicants, and the degree of selectivity that can be afforded if present plant and staff are to be maintained.

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[1] Because the pre-admission indices are expressed on different scales, the weights given in the prediction equations do not indicate the relative importance of each variable. If all three measures were expressed on the same scale, with identical means and ranges, the weights would be as follows:

Freshmen:	.466 SATV	.109 SATM	.318 HSA
Commercials:	.114 SATV	.262 SATM	.383 HSA

In general, it would seem that the levels of cutting scores recommended by the Consolidated University Admissions Committee (300 on one test, 375 on the other; or, a total score on the two of 700) have not been unduly stringent for the Woman's College, as applicants falling below these levels would have a fairly low probability of survival unless their high school records were exceptionally good. The class entering in 1958, for all practical purposes, therefore represents a relatively unselected group which should be examined at this stage as admissions policy and recommendations are formulated, and which should be followed up in later terms to determine the stability or instability of the first term averages. Examination of the frequency of various predicted grades in this group, as is now possible because of the availability of the formulas, should be helpful too in determining how much selectivity should be exercised in the present year.

VI. Limitations:

There are a number of important limitations in this study, all of which indicate the need for continued research and for the continuous exercise of judgment by the Admissions Policy Committee in the selection of applicants.

First, all the work herein relies on the validity of the academic criterion, or first term average. Many students may be late bloomers; or, some will later elect departments or majors which will inflate or deflate their present averages; or, our grading system may not measure accurately all the qualities or college-produced valuable growth.

Second, although predictability for the freshmen is about as accurate as is ever obtained in practice with such methods, many other factors not included in the equations may be important. Some of the variation of actual from predicted grades surely comes from differences in high schools which are not revealed by the high school average of each student. No account was taken of differences in preparatory courses taken by students, of principals' ratings, etc. The roster of current students showing their actual and predicted grades should be examined in this regard, in an effort to determine possible reasons for discrepancy between performance and prediction. Such reasons can be used in screening doubtful applicants, or as a basis for hypotheses for further research.

Third, the level and numbers of applicants, the grading standards, and goals of the College will surely change over time. Some of these changes may come about so rapidly that they must be anticipated, if the wisest selection of applicants is made.

Finally, a continuous search for other factors important in the formulation of admissions policy should be carried on. The needs of the state in numbers and kinds of graduates, the validity of remedial courses or alternate programs, the money the state is

willing to invest in the education of women, the effect of recruiting on the numbers and kinds of applicants -- all these must be considered if an ultimately sound policy is achieved and maintained.

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